Cont'd

27. (New) The high pressure discharge lamp according to claim 17, wherein said potassium oxide is no more than 30 ppm.- -

REMARKS

Applicant concurrently files herewith an excess claim fee for six (6) additional dependent claims.

Claims 1-4 and 6-27 are all the claims presently being examined in the application. New claims 20-27 have been added to more particularly define the invention.

Claims 1 and 2 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Barthelmes et al. (U.S. Patent No. 5,001,395). Claims 3, 4, 6, 7-11, 15, 16 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Barthelmes et al. in view of Honda et al. (U.S. Patent No. 6,249,086). Claims 14 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Barthelmes et al. in view of Honda et al. and further in view of Takeuti et al. (U.S. Patent No. 6,211,616). Claim 18 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Barthelmes et al. in view of Honda et al. and further in view of Genz (U.S. Patent No. 5,635,796).

These rejections are respectfully traversed in view of the following discussion.

Attached hereto is a marked-up version of the changes made to the specification and/or claims by the current Amendment. The attached page is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE.**"

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by claim 1, is directed to a high pressure discharge lamp.

The high pressure discharge lamp includes a quartz glass bulb, a conductive element which is airtightly sealed at a sealing portion of the quartz glass bulb, and a pair of electrodes, each electrode of the pair of electrodes being disposed in the quartz glass bulb so as to be opposite the other and each electrode of the pair of electrodes being connected to the conductive element.

A key feature of the invention is that a part of each electrode of the pair of electrodes is sealed with the quartz glass bulb at the sealing portion so as to generate a contacting portion formed by the part of each electrode of the pair of electrodes and the quartz glass bulb, and a maximum length L_{max}, of the contacting portion is defined as: L_{max} (mm) $\leq$ 200/(PxD); and a minimum length, L_{min} of the contacting portion is defined as: L_{min} (mm) $\geq$ 0.8/ (D^2x π) or L_{min} (mm) > 0.7 whichever is longer, where D is the diameter (mm) of the corresponding electrode of the pair of electrodes and P is the power (W) supplied to the corresponding electrode of the pair of electrodes.

A second embodiment, as disclosed and claimed, for example by claim 6, is directed to a high pressure discharge lamp, which includes a quartz glass bulb, conductive elements, the conductive elements being airtightly sealed at sealing portions of the quartz glass bulb, and a pair of electrodes, each electrode of the pair of electrodes being disposed so as to be opposite the other and each of the electrodes being connected to one of the conductive elements. The R_{max} of a contacting portion of each of the electrodes is about 5µm or less. The R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and

a mean value of the distance.

Conventional art depicts a high pressure discharge lamp with long contact portions as well as electrodes without any roughness of the surface. However, the conventional art with a long contacting portion tends to form cracks at the sealing portion "due to the difference between the thermal expansion coefficient of the electrode and the quartz glass bulb." In addition, conventional art without any surface roughness on the electrodes tends to cause sputtering of the electrode, and thus blackening of the bulb. (See Page 4, lines 3-10; and Page 5, lines 13-18).

An aspect of the invention includes a contacting portion with a the maximum length L_{max}, of the contacting portion is defined as: L_{max} (mm) < 200/(PxD); and the minimum length, L_{min} of the contacting portion is defined as: L_{min} (mm) > 0.8/ (D^2x π) or L_{min} (mm) > 0.7 whichever is longer.

A second aspect includes a roughness (R) of the surface of an end portion of an electrode where a R_{max} of a contacting portion of each of the electrodes is about 5μm or less. The first aspect of this configuration with a maximum length prevents weakening of the contacting portion and suppression of cracks at the contacting portion while the minimum length tends to maintain the strength of the portion supporting the electrode, and thus prevents failing of the electrode. The second aspect tends to decrease sputtering of the electrode. (See Page 5, lines 6-21; Page 13, lines 10-13; and Page 14, lines 6-9).

As a result of this inventive structure, blackening of the bulb as well as a blowout of the bulb are significantly prevented "even after being lit for a considerably long time." (See Page 5, lines 3-5).

II. THE PRIOR ART REJECTIONS

A. The 102(b) Rejection Based on Barthelmes

Barthelmes, et al. ("Barthelmes") fails to teach or suggest the features of independent claim 1, including a contacting portion formed by the part of each electrode and the quartz glass bulb.

Second, Barthelmes also fails to teach or suggest the feature of independent claim 1, a contacting portion with a specific relationship between a maximum length and a minimum length, including a maximum length L of the contacting portion is defined as: $L_{max,}$ of the contacting portion is defined as: L_{max} (mm) < 200/(PxD); and a minimum length, L_{min} of the contacting portion is defined as: L_{min} (mm) > 0.8/ (D^2x π) or L_{min} (mm) > 0.7 whichever is longer, where D is the diameter (mm) of the corresponding electrode of the pair of electrodes and P is the power (W) supplied to the corresponding electrode of the pair of electrodes.

Applicant discloses that the contacting portion, L, has a precise, specific minimum length, L_{min}, and a maximum length, L_{max} .as defined by L_{max} (mm) < 200/(PxD); and the minimum length, L_{min} of the contacting portion is defined as: L_{min} (mm) > 0.8/ (D^2x π) or L_{min} (mm) > 0.7 whichever is longer. The length, L, can not be either too long or too short as the maximum length, L_{max}, tends to prevent weakening of the contacting portion and suppression of cracks at the contacting portion and the minimum length, L_{min}, tends to maintain the strength of the portion supporting the electrode and prevent falling of the electrode. (See Page 5, lines 6-12; Page 12, line 8-13; Page 13, lines 10-13; and Page 14, lines 6-9). Therefore, the problems of blackening of the bulb and a blowout of the bulb are significantly prevented "even after being lit for a considerably long time." (See Page 5, lines 3-5).

Instead, Barthelmes only teaches "a suitable dimension" of the electrode shaft, l_E, not a precise, specific range of the specific maximum length, L_{max}, and a minimum length, L_{min} of

a contacting portion, L. Indeed, Barthelmes is focused on improving the corrosion protection of the electrodes so a suitable range of the length of a contacting portion is not taught, disclosed or suggested as part of the invention. (See Column 1, lines 50-65).

Thus, the Barthelmes lamp like other conventional devices may tend to form cracks at the sealing portion "due to the difference between the thermal expansion coefficient of the electrode and the quartz glass bulb." (See Page 4, lines 3-10; and Page 5, lines 13-18). Accordingly, Barthelmes only discloses that the electrode shaft has "suitable" dimensions.

Barthelmes, therefore, does not teach, suggest or disclose including a contacting portion with a specific relationship between the maximum length and the minimum length, including the maximum length $L_{max,}$ of the contacting portion is defined as: L_{max} (mm) < 200/(PxD); and the minimum length, L_{min} of the contacting portion is defined as: L_{min} (mm) > 0.8/ (D^2x π) or L_{min} (mm) > 0.7 whichever is longer, where D is the diameter (mm) of the corresponding electrode of the pair of electrodes and P is the power (W) supplied to the corresponding electrode of the pair of electrodes.

B. The § 103 Rejections of Claims 3, 4, 6, 7-11, 15, 16 and 19

First, the references, separately, or in combination, fail to teach, disclose or provide a reason or motivation for being combined. In particular, Barthelmes pertains to a conventional high-pressure discharge lamp with a quartz glass discharge chamber and corrosion protected electrode leads. The electrode leads, which are tightly surrounded by tubular elements of electrically insulating high-temperature resistant material, includes a shaft portion. This structure also includes "a suitable dimension" of the electrode shaft, l_E, without a range nor a surface roughness at the end portion of the electrode. (See Office Action at Page 4, Section 5). Accordingly, Barthelmes is specifically directed to improving the corrosion protection of

the electrodes where the "discharge vessel includes a fill with which [h]as highly corrosive additives therein in order to provide light output at a desired color temperature." (See Barthelmes at Abstract; Column 1, lines 50-65; and Figure 1).

By contrast, Honda, et al. ("Honda") does not have the same aim as Barthelmes.

Honda discloses a conventional high-pressure discharge lamp including a light transmitting air-tight discharge container, an electrode formed of tungsten sealed in the discharge container and a discharge medium containing a halide of a light emitting metal with a surface roughness. The surface roughness of the electrode is defined as, " the average value of center line average roughness Ra of the surface, is set to 0.3μm or less, or the average value of the center line average roughness Rz of the surface of the electrode, is set to 1.0μm or less, or the average value of the surface area increasing rate of the surface of the electrode is to 1.0% or less." (See Honda at Abstract; Column 1, lines 10-23). This configuration attempts to reduce the carbon impurities on the surface of the electrode, which diminishes the blackening of the bulb, and thus may not decrease the luminous flux within 100 hours of lighting. (See Column 3, lines 28-55). Nothing within Barthelmes, without a surface roughness on the electrode, suggests a high-pressure discharge lamp to reduce the carbon impurities on the surface of the electrode and not decrease the luminous flux within 100 hours of lighting with a specific surface roughness of the electrode as disclosed in Honda. Thus, Barthelmes teaches away from being combined with another invention, such as, Honda.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight. It is clear that the Examiner has simply read Applicant's specification and conducted a keyword search to yield Barthelmes and Honda. The Examiner provides no motivation or reason to combine other than to assert that it would have been obvious to one having ordinary skill in the art at the time to attempt to make the bulb of Barthelmes into a

long life bulb by incorporating an electrode with a surface roughness of an electrode from Honda. Such an assertion does not take into account the distinct structural differences of the two inventions as indicated above, and further discussed below. Thus, the Examiner's conclusion attempts to solve a problem which may not exist with either Barthelmes or Honda.

Second, even if combined, the references do not teach or suggest the features of independent claim 6, including R_{max} of a contacting portion of each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance.

The Examiner admits that Barthelmes does not disclose, teach or suggest, "an electrode surface roughness at the end portion." (See Office Action at Page 4, Section 5). Further, Barthelmes does not disclose, teach or suggest including an R_{max} of a contacting portion of each of the electrodes is about 5μm or less.

Honda does not make up for the deficiencies of Barthelmes. Instead, Honda discloses a conventional high-pressure discharge lamp including with an electrode formed of tungsten sealed in the discharge container and a discharge medium containing a halide of a light emitting metal with a surface roughness. The surface roughness of the electrode is defined as, " the average value of center line average roughness Ra of the surface, is set to 0.3μm or less, or the average value of the center line average roughness Rz of the surface of the electrode, is set to 1.0μm or less, or the average value of the surface area increasing rate of the surface of the electrode is to 1.0% or less." (See Honda at Abstract; Column 1, lines 10-23). Honda teaches that the surface roughness is throughout the length of the electrode formed by a tungsten wire wound around the electrode by "a wire drawing method." (See Column 16, lines 9-67).

In contrast, Applicant's invention discloses including a R_{max} of a contacting portion of

each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance. In particular, the contacting portion is a discrete portion of the electrode referred to as L, which extends into the foil as recited in new dependent claims 20 and 31. (See Page 6, lines 17-24; and Page 18, line 15-Page 19, line 16).

Further, Honda wraps a tungsten wire around the smooth electrode surface to form the rough surface before any type of electrolytic polishing occurs whereas the invention discloses that the "maximum value Rmax, of the surface roughness of an electrode which may be obtained by subjecting a surface to machining is generally 12μm[.]" and polishing occurs to reduce the very rough surface to a rough surface of a desired Rmax, just the opposite from Honda.

Accordingly, Honda, does not disclose, teach or suggest any contacting portion, let alone, Applicant's feature of R_{max} of a contacting portion of each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance.

Therefore, neither Barthelmes nor Honda teaches or suggests a R_{max} of a contacting portion of each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance. as recited in claim 6, i.e., Applicant's invention which provides a high pressure discharge lamp which prevents the weakening of the contacting portion and suppresses cracks at the contacting portion as well as reduces the sputtering of the electrode. (See Page 5, lines 6-21; Page 13, lines 10-13; and Page 14, lines 6-9).

For at least the reasons outlined above, Applicant respectfully submits that neither Barthelmes nor Honda disclose, teach or suggest all of the features of the independent claim 6 and dependent claims 3, 4, 7-11, 15, 16 and 19, claims 7-11, 15, 16 and 19 are patentable not only by virtue of their dependency from the respective independent claim 6, but also by the additional limitations they recite.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 6, should be fully patentable over the cited references.

C. The § 103 Rejection of Claims 14 and 17

To make up for the deficiencies of Barthelmes and Honda, the Examiner relies on Takeuti, et al. ("Takeuti"). Takeuti fails to do so.

First, Takeuti does not have the same aim as either Barthelmes or Honda as discussed above, and the urged combination would not have been made, absent hindsight.

Secondly, Takeuti does not disclose, teach or suggest including a R_{max} of a contacting portion of each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance as recited in claim 6.

Further, Takeuti does not disclose, teach or suggest including where a mercury vapor is contained in the high pressure discharge lamp in an amount between about 0.12 and 0.3 mg/mm^3 as recited in claim 14 of the invention. Further, Takeuti does not disclose, teach or suggest including the pair of electrodes comprises tungsten containing potassium oxide as recited in claim 17.

Instead, Takeuti recites a high pressure discharge lamp without any surface roughness on an electrode. (See Takeuti at Abstract; and Figure 1). Since the lamp does not have any

surface roughness, Takeuti is deficient and thus does not teach the specific limitations of dependent claims 14 and 17.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 6, and related dependent claims 14 and 17, should be fully patentable over the cited references.

D. The § 103 Rejection of Claim 18

To make up for the deficiencies of Barthelmes and Honda, the Examiner relies on Genz. Genz fails to do so.

First, Genz does not have the same aim as either Barthelmes or Honda as discussed above, and the urged combination would not have been made, absent hindsight.

Genz further does not disclose, teach or suggest including a R_{max} of a contacting portion of each of the electrodes is about 5μm or less, where R_{max} is a maximum of an absolute value of a difference between a distance from an axial center of each of the electrodes to a particular point on a surface of each of the electrodes and a mean value of the distance as recited in claim 6, let alone, including the bulb wall loading in the high pressure discharge lamp is about 0.8 W/mm^2 or more as recited in claim 18.

Instead, Genz recites a high pressure discharge lamp without any surface roughness on an electrode. (See Takeuti at Abstract; and Figure 1). Since the lamp does not have any surface roughness, Genz is deficient and thus does not teach the specific limitations of dependent claim 18.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 6, and related dependent claim 18, should be fully patentable over the cited references.

IV. FORMAL MATTERS AND CONCLUSION

The attached Request for Approval of Drawing Corrections amends Figure 1 to more clearly show the axial center of each electrode with a dotted line referred to as part 43. Second, although the specification at Page 20, lines 5-18 clearly defines "an end portion of the electrode," which is clearly shown in Figure 1, to speed prosecution, Applicant has amended the claim from "an end portion of the electrode" to "a contacting portion," which is exemplarily shown as L in Figure 1. Thus, this Amendment should clarify the length comprising the "portion other than the contacting portion."

In view of the foregoing, Applicant submits that claims 1-4 and 6-27, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 2/27/03

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specifications:

Please amend the following paragraph starting on Page 11, line 14 through line 21:

In the high pressure discharge lamp according to this embodiment of the invention, as shown in FIG. [1] 5, electrodes 2a and 2b are joined to Mo foils 3a and 3b, respectively, and a part of the electrodes 2a and 2b and the Mo foils 3a and 3b are sealed at their respective ends of a quartz glass bulb 1. The shrink sealing method is used for sealing the quartz glass bulb 1. That is, the sealing process is carried out by naturally shrinking the quartz glass bulb 1 after heating the quartz glass bulb 1 while maintaining a predetermined difference in pressure between the inside and outside of the quartz glass bulb 1.

Please amend the following paragraph starting on Page 18, line 5 through line 14:

FIG. 6 is a graph showing the relationship between the maximum value, R_{max}, of the surface roughness of an electrode at the contacting portion and the defect percentage. In the example shown in FIG.6, the power supplied to the high pressure discharge lamp was 200 W, the diameter φ of the electrode was 0.6 mm, and the length of the contacting portion formed by contacting the electrode and the quartz glass bulb was 1.2 mm. The surface roughness of the electrode was measured by using a contact-type surface roughness of the electrode was measured by using a contact-type surface roughness measuring instrument. The maximum value R_{max}, of the surface roughness of the electrode is defined as the maximum of the absolute value of the difference between the distance from the axial center 43 of the electrode (as shown in FIG. 1) to a particular point on the surface of the electrode and the mean value of the distance.

In the claims:

Claim 5 has been canceled without prejudice or disclaimer.

1. (Amended) A high pressure discharge lamp, comprising:

a quartz glass bulb;

a conductive element which is airtightly sealed at a sealing portion of said quartz glass bulb; and

a pair of electrodes, each electrode of said pair of electrodes being disposed in said quartz glass bulb so as to be opposite the other and said each electrode of said pair of electrodes being connected to said conductive element,

wherein a part of said each electrode of said pair of electrodes is sealed with said quartz glass bulb at said sealing portion so as to generate a contacting portion formed by the part of each electrode of said pair of electrodes and said quartz glass bulb, and

[the] a maximum length $L_{max,}$ of the contacting portion is defined as:

L_{max} (mm) $\leq 200/(PxD)$; and

[the] a minimum length, $L_{min,}$ of the contacting portion is defined as:

L_{min} (mm) $\geq 0.8/ (D^2 x \pi)$ or

L_{min} (mm) ≥ 0.7 whichever is longer,

where D is the diameter (mm) of the corresponding electrode of said pair of electrodes and P is the power (W) supplied to the corresponding electrode of said pair of electrodes.

2. (Amended) A high pressure discharge lamp according to claim 1, wherein said conductive element [is] comprises molybdenum foils.

6. (Amended) A high pressure discharge lamp, comprising:

a quartz glass bulb;

conductive elements, said conductive elements being airtightly sealed at sealing portions of said quartz glass bulb; and

a pair of electrodes, each electrode of said pair of electrodes being disposed so as to be opposite the other and each of said electrodes being connected to one of said conductive elements,

wherein R_{max} of [an end portion] a contacting portion of each of said electrodes is about 5μm or less, wherein R_{max} is [the] a maximum of [the] an absolute value of [the] a difference between [the] a distance from [the] an axial center of each of said electrodes to a particular point on [the] a surface of each of said electrodes and [the] a mean value of the distance.

7. (Amended) A high pressure discharge lamp according to claim 6, wherein conductive elements [are] comprises molybdenum foils.

8. (Amended) A high pressure discharge lamp according to claim 6, wherein

the length of said [end] contacting portion of each of said electrodes is in the range between about P/150 and P/100 mm from an end of each of said electrodes along the length of each of said electrodes, where P is a supplied power to said high pressure discharge lamp in watts.

9. (Amended) A high pressure discharge lamp according to claim 6, wherein the maximum value of the surface roughness of the [end] contacting portion of each of said electrodes is about 3μm or less.

10. (Amended) A high pressure discharge lamp according to claim 6, wherein the maximum value of the surface roughness of the [end] contacting portion of each of said electrodes is about 1μm or less.

11. (Amended) A high pressure discharge lamp according to claim 6, wherein the maximum value of the surface roughness of the [end] contacting portion of each of said electrodes is about 0.5μm or less.

19. (Amended) A high pressure discharge lamp according to claim 6, wherein the [end] contacting portion of each of said electrodes has a surface, said surface being polished by a composite electrolytic polishing method.